

SCREENING OF SUITABLE GERMPLASM OF TUBEROSE (*POLIANTHES TUBEROSE* L.) FOR MID HILL CONDITIONS OF GARHWAL HIMALAYAS

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ABSTRACT

Ten Tuberose (*Polianthes tuberosa* L.) genotypes were assessed for their performance under mid hill conditions of Garhwal Himalayas during 2015. Uniform healthy bulbs were planted at a spacing of 30cm × 20cm in randomized complete block design with three replications. Significant differences were obtained among the genotypes for all vegetative and floral characters studied. The minimum days taken for bulb sprouting (28.66) and maximum yield of florets (2.00 kg) were found in Hyderabad Double. The maximum plant height (42.55 cm) was observed in Hybrid -1 whereas; the higher plant spread (45.20 cm) was observed from Maxima Single genotype. Shringar genotype was recorded to have maximum number of leaves (58.30) and vase life (10.20 days). Prajwal genotype recorded maximum leaf area (38.19 sq.cm), number of spike per plant (3.93), number of spike per m² (25.66), number of florets per spike (35.53) and spike weight (97.25 g) with minimum days taken to spike emergence (60.00). However, maximum floret diameter (4.35 cm) and flowering duration (11.73 days) were found in genotype Vaibhav and maximum (77.63 cm) length of spike in Sikkim Selection.

KEYWORDS: Screening, Tuberose and Genotypes

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INTRODUCTION

Cultivation of flower has now become an important agri-business all over the world. In India during the last five years floriculture industry has undergone progressive changes. Out of the various commercial flower crops, tuberose is an important flower crop which is used as a cut flower, loose flower and for oil extraction purpose. It can be planted in beds and borders and can also be grown as potted plants (Sathynarayana *et al.*, 1994). The fascinating long spikes of waxy petals with pleasant aroma have led it to occupy a very special position among the flower growers. Tuberose botanically known as (*Polianthes tuberosa* L.) is a member of Amaryllidaceae family and was originated in Mexico. It is an important flower crop of tropical and subtropical areas (Tiware and Singh, 2002).

It can be easily grown in a wide range of soils and under varied climatic conditions. Due to its increasing demand, farmers have begun growing tuberose as a field crop under different management practices. So knowledge of good variety, proper spacing, optimum size of bulbs, fertilizer requirement, irrigation schedule and use of optimum time of planting etc. are some of the important factors that may help in increasing the yield and quality of tuberose (Anjum *et al.*, 2001). Keeping this in mind, different tuberose varieties were assessed to screen

out suitable variety of tuberose whose's cultivation can be recommended and profitable to the farmers.

MATERIALS AND METHODS

The study was conducted at the Floriculture and Landscaping block, College of Horticulture, Veer Chandra Singh Garhwali UHF, Bharsar, Pauri Garhwal, and Uttarakhand, India during 2015-16. Bulbs of 10 genotypes of tuberose namely Hybrid-1, Prajwal, Vaibhav, Shringar, Swarn Rekha, Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single were assessed for their performance. Bulbs of uniform size (1.5-2.0 cm diameter) were treated with bavistin (0.2%) for 30 minutes and then air dried later planted at a depth of 5 cm. The bulbs were planted in open field conditions at spacing of 30 cm × 20 cm in randomized block design with three replications. All the uniform standard cultural practices were followed during the crop period. Observations on several growth and flowering characters, viz Days taken to bulb sprouting, plant height (cm), plant spread (cm), number of leaves per plant, Leaf area (sq.cm), Days taken to spike emergence, Length of spike (cm), Number of spike/plant, Number of spike/m² Number of florets/spike, Floret diameter (cm), Weight of spike (g), Flowering duration (days), Vase life (days) and Yield of florets (kg) were recorded and subjected to analysis as per the methods by Cochran and Cox (1992).

RESULTS AND DISCUSSIONS

Data presented in Table 1 and 2 revealed that there is a significant variation among all the genotypes studied for different vegetative and floral characteristics. All the genotypes were also compared between themselves during the course of study.

It is vividly evident from the perusal of data presented in (Table 1) that days taken for bulb sprouting ranged from 28.66 to 39.33 days. Among all genotypes, minimum days for sprouting of bulb were recorded in genotype Vaibhav (28.66), while maximum (39.33) days were observed in G9 i.e. Hyderabad Double.

Among the comparisons between different genotypes studied during the course of investigation, genotype Hybrid-1 was highly significant over Swarn Rekha, Sikkim Selection, GKTC-4 and Pearl. Genotype Prajwal was found to be highly significant over Shringar, Swarn Rekha, Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single. Genotype (G₃) Vaibhav was highly significant over Swarn Rekha, Sikkim Selection, GKTC-4, and Pearl and significant over Hyderabad Double. Genotype Shringar was highly significant over Swarn Rekha, Sikkim Selection, GKTC-4 and Pearl. Genotype Swarn Rekha was highly significant over Sikkim Selection, Pearl, Hyderabad Double and Maxima Single. Genotype "Sikkim Selection" was highly significant over GKTC-4, Pearl, Hyderabad Double and Maxima Single. Genotype GKTC-4 was highly significant over Hyderabad Double and Maxima Single. And lastly Pearl was highly significant over Hyderabad Double and Maxima Single. The variation among the genotypes in days to sprouting of bulbs is might be due to the genotypic differences between them. It is in line with the findings of Safiullah and Ahmed (2001) and Nair and Shiva (2003) in *Gladiolus*.

Maximum plant height (42.55cm) was recorded in genotype Hybrid-1 (G₁), while minimum (24.53 cm) plant height was observed in genotype Swarn Rekha (G₅). While comparing different genotypes for plant height, genotype Hybrid-1 was found to be significant over Prajwal and highly significant over other genotypes. Genotypes Prajwal was highly significant over other genotypes except Vaibhav and Vaibhav was significantly higher over other genotypes except Sikkim Selection. This variation in plant height is may be due to the genotypic differences which resulted in phenotypic expression of the traits and variations in different genotype-environmental interaction. Similar results were obtained by

Nagaraju and Parthasarthy (2001) in *Gladiolus* and Srinivas *et al.* (1995) in tuberose.

Maximum number of leaves per plant was obtained in genotype Shringar (58.30) and minimum number of leaves per plant was recorded in genotype Maxima Single (33.73). Among the comparison between different genotypes studied genotype Hybrid-1 was highly significant over Prajwal, Vaibhav and Maxima Single except other genotypes. "Prajwal" was highly significant over Swarn Rekha, Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single. Vaibhav was highly significant over Swarn Rekha, Sikkim Selection, GKTC-4, Pearl and Maxima Single and significant over Hyderabad Double. Shringar was highly significant over Swarn Rekha, Sikkim Selection, GKTC4, Pearl, Hyderabad Double, and Maxima Single. Sikkim Selection was significant over Maxima Single except other genotypes. GKTC-4 was significant over Maxima Single and Genotype Hyderabad Double was highly significant over Maxima Single. This variation of number of leaves per plant among various genotypes may be due to the hereditary traits, which is further modified by prevailing environmental condition which has been advocated by Bhaskar and Reddy (2006). It has further been supported by **Radhakrishna *et al.*, (2003)** who indicated the presence of additive gene effect for most of the traits in tuberose.

Leaves are the photosynthetic part of the plant which is directly related to the yield. Maximum leaf area was recorded in Prajwal 38.19 cm² and was significantly higher over other genotype, whereas, minimum (32.44) leaf area was recorded in Sikkim Selection. While comparing different genotype for leaf area, it was found that "Hybrid-1" was highly significant over Vaibhav except other genotypes. Prajwal was significant over Shringar and highly significant over genotypes as Swarn Rekha, Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single. Genotype Vaibhav was significant over Swarna Rekha, GKTC-4 and highly significant over Sikkim Selection, Pearl, Hyderabad Double, Maxima Single. Genotype Shringar was highly significant over Sikkim Selection. This variation in the number of leaves is might be due to their genetic alignment, which interacts differently to soil and climatic conditions. (Balaram *et al.*, 2009; Pragya *et al.*, 2010; Saleem *et al.* 2013).

Days taken to spike emergence is an important character describing the earliness of different genotypes which is useful in the selection of varieties. Among the various genotypes assessed, it was found that all the genotypes took about 60-65 days for spike emergence. Less number of days (60.00) to spike emergence was recorded in "Prajwal" and was statistically at par with the genotype GKTC-4, whereas, maximum days (64.67) for spike emergence was recorded in genotype Maxima Single (G₁₀) and was statistically at par with the genotypes Swarn Rekha and Hyderabad Double. Among the comparison between different genotypes it was found that genotype Hybrid-1 was highly significant over genotypes Prajwal, Swarn Rekha, GKTC-4, Maxima single and significant over Vaibhav and Maxima single. Vaibhav was highly significant over GKTC-4 and significant over Maxima single. Shringar was highly significant over GKTC-4 and significant over Maxima Single and Swarn Rekha was highly significant over GKTC-4. Sikkim Selection was highly significant over GKTC-4 and significant over Maxima Single. GKTC-4 was highly significant over Pearl, Hyderabad Double and Maxima Single. The variation in days taken to spike emergence might be primarily governed by the genetic makeup of the varieties these results were also experimentally supported by the findings of Nagaraju and Parthasarthy (2001) in *gladiolus* and **Biswas *et al.* (2002)** in tuberose.

It is vividly evident from the persual of data presented in Table 4.3 that length of spike, ranged from 35.06 to 77.63. Maximum length of spike (77.63) was obtained in genotype Sikkim selection, whereas, minimum length of spike (35.06) was recorded in genotype GKTC-4. While comparing different genotype for length of spike genotype Hybrid -1

was found to be highly significant over Sikkim Selection. Genotype Prajwal was significant over GKTC-4. Vaibhav was significant over Sikkim selection. Shringar was highly significant over Sikkim selection. Sikkim Selection was highly significant over GKTC-4 and Maxima Single. GKTC-4 was significant over Pearl and highly significant over Hyderabad Double. The variation in spike length of different varieties might be due their varietal character. This has been confirmed by Arora and Khanna (1990) in *Gladiolus*, Narain (1995) and Meerow (2000) in *amaryllis* Ramachandralu and Thangam (2009) in *Tuberose*.

It is evident from the data presented in Table No 2 regarding the yield of spike per plant that number of spike per plant ranged from 1.40 to 3.93. Maximum number of spike/plant (3.93) was obtained in genotype Prajwal and minimum was recorded in genotype Sikkim Selection (1.40) and it was statistically at par with G₁ (1.80), G₃ (1.80), G₅ (1.73), G₉ (1.66) and G₁₁ (1.66). Among the comparison between different genotype studied during the course of investigation Genotype Hybrid -1 was highly significant over Prajwal and GKTC-4. Prajwal was highly significant over Vaibhav, Shringar, Swarn Rekha, Sikkim Selection, Pearl, and Hyderabad Double Maxima Single and significant over GKTC-4. Genotype Vaibhav was highly significant over GKTC-4. Shringar was significant over GKTC-4. Swarn Rekha was highly significant over GKTC-4. Sikkim Selection was highly significant over GKTC-4 and genotype GKTC-4 was highly significant over Hyderabad Double and Maxima Single.

Observations on number of spike/ m² have been presented in Table 2 where maximum number of spike/m² was recorded in genotype Prajwal (25.66) whereas, minimum number of spike /m² (12.00) was recorded in genotype Sikkim Selection and it was found to be statistically at par with Maxima Single (13.33). This variation in the production of spikes/plant and spikes per plot is might be due to the genetically controlled factor and also due to the hereditary traits of different cultivars under prevailing environment. This variation in spikes per plant are in accordance with the findings of Sateesha *et al.* (11) in cv. Prajwal, Martolia and Srivastava (9), Ramachandrudu and Thangam (2009) in cvs. Suvasini (2.43) to Mexican Single (5.73) at Goa conditions for tuberose.

Among the various genotypes assessed number of floret per spike ranged from 21.20 to 35.53. Where maximum number of floret per spike was observed in genotype Prajwal (35.53) whereas, minimum (21.20) number of floret per spike was recorded in genotype Hyderabad Double and it was statistically at par with Maxima Single (34.26). Comparison of different genotypes for number of floret per spike revealed that Genotype Hybrid -1 was highly significant over Prajwal, GKTC-4 and Maxima Single. Genotype Prajwal was significant over Vaibhav and highly significantly over Shringar, Swarn Rekha, Sikkim Selection, GKTC-4, Pearl and Hyderabad Double. Genotype Vaibhav was significant over Sikkim selection and highly significant over GKTC-4, Maxima Single and Pearl. Shringar was highly significantly over GKTC-4, Pearl and Maxima Single. Swarn Rekha was highly significantly over GKTC-4 and Maxima Single. GKTC-4 was significant over Pearl and highly significant over Hyderabad Double and Maxima Single. Hereditary traits of different genotypes might have caused this variation. Similar results were observed during the evaluation of tuberose by Gaurav *et al.*, 2005 and Krishnamoorthy, 2014. In other bulbous crops such as *Gladiolus*, similar variation in number of florets was observed by Rani and Singh (2005) and Ram *et al.* (2005).

The floret diameter in the evaluated genotypes ranged from 3.22 to 4.35 cm. Maximum floret diameter (4.35 cm) was recorded in the genotype Vaibhav, whereas, minimum floret diameter (3.22) was recorded in genotype Pearl and it was statistically at par with genotype GKTC-4 (3.23). The data pertinent to the comparison revealed that Hybrid-1 was highly significant over GKTC-4, Pearl and significant over Shringar. Genotype Prajwal was highly significant over GKTC-4 and

Pearl. Vaibhav was significant over Shringar and Hyderabad Double and highly significant over GKTC-4 and Pearl. Swarn Rekha was highly significant over GKTC-4 and Pearl. Genotype GKTC-4 was highly significant over Maxima Single. Pearl was highly significant over Maxima Single. The variation in floret diameter is might be due to the genetic makeup of the varieties and the prevailing conditions during the field trial. These are in conformity with the findings of Mahawer *et al.*, 2013 in Tuberose.

Weight of spike is an important parameter for assessing its market value as a cut flower as strong and sturdy stem is preferred in a cut flower. The data pertaining to spike weight revealed that maximum (97.25 g) spike weight was recorded in genotype Prajwal, whereas, minimum spike weight (94.90 g) was recorded in genotype GKTC-4 and it was statistically at par with Genotype Vaibhav. The genotypes when compared among themselves revealed that genotype Hybrid-1 was highly significant over all other genotypes except Swarn Rekha. Genotype Prajwal was also highly significant over all except Vaibhav and Hybrid-1. Vaibhav was highly significant over Shringar, Swarn Rekha, Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single. Shringar was highly significant over Swarn Rekha, GKTC-4, Hyderabad Double and Maxima Single. Swarn Rekha was highly significant over Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single. Sikkim Selection was highly significant over GKTC-4, Hyderabad Double and Maxima Single. GKTC-4 was highly significant over Pearl, Hyderabad Double and Maxima Single. Pearl was highly significant over Hyderabad Double and Maxima Single. Hyderabad Double was highly significant over Maxima Single. These variations in spike weight might be due to different genetic make-up of the different cultivars and prevailing environment conditions of the experimental area. These results are in corroboration with the findings of Mahawer *et al.* 2008, Mahawer *et al.*, 2013 in Tuberose.

The data presented in Table No 2 revealed significant differences among various genotypes for flowering duration. Longest flowering duration (12.20) was recorded in genotype Prajwal, whereas, shortest (8.60) flowering duration was of genotype Hybrid-1 and it was statistically at par with Genotypes GKTC-4 and Maxima Single. The comparison of flowering duration between the genotypes revealed that Hybrid-1 was highly significant over Prajwal, Vaibhav, Sikkim Selection and Hyderabad Double and significant over Pearl. Prajwal was highly significant over Shringar, Swarn Rekha, Sikkim Selection, GKTC-4, Pearl, Hyderabad Double and Maxima Single. Genotype Sikkim Selection was significant over GKTC-4 and genotype GKTC-4 was significant over Pearl and highly significant over Hyderabad Double. The differences in the flowering duration among the genotypes could be due to the variation in the carbohydrate reserves of the plant as blooming is an energy requiring process. This is in line with the findings of Chourasia *et al.*, 2015 in Gladiolus.

Genotypes having longer vase life are desirable for preparing bouquets, interior decoration and many more. The data pertaining to vase life presented in Table No 3 showed significant difference among various genotype. Maximum vase life (10.20) was recorded in genotype Shringar, whereas, minimum vase life (7.13) was recorded in genotype GKTC-4. Among the comparison between different genotypes studied during the course of investigation. Hybrid-1 was found to be significant over Shringar. Vaibhav was significant over Shringar. Shringar was highly significant over Sikkim Selection, GKTC-4 and significant over Pearl, Hyderabad Double and Maxima Single. This variation among the vase life of different genotypes might be due to the differential accumulation of carbohydrates, varied leaf numbers and area as well as varied sensitivity of genotypes to ethylene, which is a varietal character. Similar results were Kumar and Yadav (2005), Choudhary *et al.*, 2011 in gladiolus.

Table: 1-Screening of Tuberose Germplasm for Various Vegetative Parameters

Genotypes	Days Taken for Bulb Sprouting	Plant Height (CM)	Plant Spread (CM)	Number of Leaves Per Plant	Leaf Area (SQ.CM)	Days taken to Spike Emergence
	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)
G1	33.00*±0.557	42.55*±1.28	37.80±2.00	43.33*±0.75	34.54*±0.36	62.33*±0.33
G2	31.00*±0.577	35.97*±1.69	45.13*±0.33	56.26*±1.26	38.19*±0.26	60.00±0.00
G3	28.66±0.333	31.70*±0.95	38.30*±1.00	50.53*±2.05	37.01*±0.47	63.00*±0.00
G4	35.00*±0.577	24.80±1.71	36.56±1.78	58.30*±0.30	35.91*±0.19	63.00*±0.00
G5	34.33±0.333	24.53±0.81	37.13±2.35	35.86±0.52	34.43*±0.61	64.33*±0.33
G6	33.66*±0.333	26.81±1.00	40.96*±1.35	39.20*±0.20	32.44±0.55	63.00*±0.00
G7	32.00*±0.577	24.92±0.45	35.80±1.20	38.66*±0.33	34.46*±0.34	60.33±0.33
G8	30.33*±0.333	24.70±0.84	32.63±1.92	38.00±0.00	34.10*±0.43	63.33*±0.33
G9	39.33*±0.333	24.97±1.40	38.13±4.43	40.93*±1.46	34.05*±0.60	64.00*±0.57
G10	31.66*±1.202	24.69±1.76	45.20*±0.94	33.73±3.57	33.83*±0.43	64.66*±0.33
SE(d)	0.78	1.75	2.60	2.18	0.53	0.43
C.D.	1.67	3.70	5.51	4.62	1.13	0.92

Table 2: Screening of Suitable Germplasm of Tuberose for Various Floral Parameters

Genot ypes	Length of Spike (cm)	Number of Spike/plant	Number of Spike/m ²	Number of Floret/Spike	Floret Diameter (cm)	Spike Weight (g)	Flowering Duration (days)	Vase Life
	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)	MEAN±SE(M)
G1	50.90*±1.67	1.80±0.11	18.00*±0.57	28.26*±0.63	4.30*±0.06	53.52*±0.69	8.60±0.23	7.36±0.31
G2	58.80*±8.25	3.93*±0.24	25.66*±0.33	35.53*±1.20	4.08*±0.05	97.25*±0.52	12.20*±0.11	8.50±0.26
G3	53.66*±3.67	1.80±0.00	16.33*±0.33	31.60*±0.34	4.35*±0.225	94.90*±0.75	11.73*±0.29	7.23±0.14
G4	49.40*±1.00	2.00*±0.11	22.33*±0.66	29.80*±0.41	3.68*±0.23	66.69*±1.45	9.33*±0.17	10.20*±0.98
G5	50.23*±0.03	1.73±0.06	15.00*±0.57	28.13*±0.76	4.00*±0.05	54.48*±0.40	9.40*±0.30	8.03±0.52
G6	77.63*±0.68	1.40±0.11	12.00±0.00	27.73*±0.48	3.82*±0.07	63.82*±1.29	10.00*±0.30	7.16±0.16
G7	35.06±4.28	2.93*±0.26	23.33*±0.33	21.20±0.50	3.23±0.04	34.26±1.12	8.66±0.06	7.13±0.59
G8	60.26*±1.13	2.06*±0.37	21.66*±0.33	25.33*±0.40	3.22±0.03	63.40*±0.52	9.93*±0.26	7.46±0.73
G9	63.53*±2.03	1.66±0.06	21.33*±0.88	31.06*±1.21	3.77*±0.00	82.63*±0.92	10.20*±0.20	7.23±0.14
G10	46.76*±7.89	1.66±0.06	13.33±0.33	34.26*±0.65	3.99*±0.05	44.35*±0.64	9.20±0.11	7.40±0.30
SE(d)	5.23	0.26	0.72	0.78	0.16	0.87	0.32	0.68
C.D.	11.07	0.56	1.52	1.66	0.35	1.85	0.68	1.45

CONCLUSIONS

It can be thus be concluded that out of the ten genotypes screened for mid hill condition of Himalayas, genotype Prajwal which performed best in terms of several important parameters such as leaf area, number of spike per plant, number of spike/m², no. of floret/ spike and spike Weight can be recommended for cultivation followed by Vaibhav, Shringar and Hyderabad Double. These genotypes can be popularized among farmers for marketing and earning more profit.

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